

Claims:

1. A thin, reinforced concrete panel comprising substantially a rectangular body of concrete having a first face and an opposite second face, said faces being flat and parallel to one another; a pair of opposite side edges; and a pair of opposite end edges,
- 5 edges,
- a first set of prestressed, parallel tendons extending through said body between said opposite end edges and perpendicularly to said end edges,
- a second set of prestressed, parallel tendons extending through said body between said opposite side edges and perpendicularly to said side edges,
- 10 all of said tendons being of substantially the same diameter,
- said first set of tendons comprising a plurality of pairs of tendons,
- each of said pairs of said first set comprising a first tendon and a second tendon,
- said first tendons being spaced a first predetermined distance from said first face of said body,
- 15 said second tendons being spaced said first predetermined distance from said second face of said body,
- said first predetermined distance being less than one half the distance between said faces,
- said first and second tendons of each pair being offset laterally from one another,
- 20 another,
- said second set of tendons comprising a plurality of pairs of tendons,
- each of said pairs of said second set comprising a third tendon and a fourth tendon,
- said third tendon being spaced a second predetermined distance from said first face of said body,
- 25 face of said body,
- said fourth tendon being spaced said second predetermined distance from said second face of said body,
- said third and fourth tendons of each pair being offset laterally from one another,

said second predetermined distance being greater than said first predetermined distance by an amount substantially equal to the said diameter of said tendons,

the pairs of tendons of said first set being spaced substantially equidistantly from each adjacent pair,

5 the pairs of tendons of said second set being spaced substantially equidistantly from each adjacent pair, and

each of said tendons being pretensioned to substantially the same tension.

2. A concrete panel as set forth in claim 1, wherein said first face and
10 second face are spaced apart a distance no greater than 1.5 inches.

3. A concrete panel as set forth in claim 2, wherein said tendons have a diameter no greater than 1/8 inch.

15 4. A concrete panel as set forth in claim 1 wherein said first face and said second face are spaced apart a distance no greater than one inch.

5. A concrete panel as set forth in claim 4 wherein said tendons have a diameter no greater than 5/64 inch.

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6. A concrete panel as set forth in claim 1 where in the tendons in said panel have a prestress of about 250 psi in each direction

7. A concrete panel as set forth in claim 1 wherein said tendons are wire
25 ropes of substantially circular cross-section having a diameter no greater than about 1/10 the distance between said first and second faces.

8. A concrete panel as set forth in claim 7 wherein each said first wire rope is spaced from said first face a distance no less than twice the diameter of said first wire rope.

5 9. A concrete panel as set forth in claim 7 where in each said second wire rope is spaced from said second face a distance no less than twice the diameter of said second wire rope.

10 10. A thin, reinforced concrete panel comprising a substantially rectangular body of concrete having a first face and an opposite second face, a pair of opposite parallel side edges and a pair of opposite parallel end edges, and having a mid plane between said faces,
said first and second faces being flat and parallel,
a first set of a plurality of prestressed tendons extending laterally of said panel
15 between said sides edges,
a second set of a plurality of prestressed tendons extending longitudinally of said panel between said end edges,
said first set of tendons being positioned in equal number and equidistantly on opposite sides of said mid plane,
20 said second set of tendons being positioned in equal number and equidistantly on opposite sides of said mid plane.

11. A thin, reinforced concrete panel comprising a rectangular body of concrete having a first face and an opposite second face, a pair of opposite side edges and a pair of opposite end edges, the body having a first cross sectional area defined by
25 the first and second faces and the opposite side edges and having a center of area defining a first centroidal plane extending between the side and end edges, and
a plurality of pairs of tendons extending through said body between the opposite side edges and positioned so that one said tendons of each pair is spaced a first

predetermined distance from the first centroidal plane proximate the first face and the other said tendons of each pair is spaced said first predetermined distance from the first centroidal plane proximate the second face.

- 5 12. The concrete panel as set forth in claim 11 wherein the body has a second cross sectional area defined by the first and second faces and the end edges and having a center of area defining a second centroidal plane extending between the end edges and perpendicular to and co-planar with the first centroidal plane, and
- 10 a plurality of pairs of tendons extending through said body between the opposite end edges and positioned so that one said tendon of each pair is spaced a second predetermined distance from the second centroidal axis proximate the first face and the other said tendon of each pair is spaced said second predetermined distance from the second centroidal axis proximate the second face.

- 15 13. The concrete panel as set forth in claim 12 wherein all of said tendons are of the same diameter and the second predetermined distance is greater than the first predetermined distance by an amount substantially equal to the diameter of said tension elements.

- 20 14. A concrete panel as set forth in claim 11 wherein said first face is defined by a plurality of longitudinal and lateral ribs and intervening depressions in a waffle-like pattern and said pairs of tendons extend one pair through each of said ribs.

- 25 15. A thin reinforced concrete panel as set forth in claim 11 wherein one of said faces is defined by a waffle-like grid.

16. A thin, reinforced concrete panel comprising a substantially rectangular body of concrete having a first face and an opposite second face, a pair of opposite side edges, and a pair of opposite end edges,

said first face being flat,
said second face having a waffle-like configuration defined by a plurality of parallel, lateral ribs extending between said side edges and a plurality of parallel, longitudinal ribs extending between said end edges, and intervening indentations,
5 said panel having a centroidal plane,
 a first set of prestressed, parallel tendons extending through said body between said opposite end edges and perpendicularly to said end edges,
 a second set of prestressed, parallel tendons extending through said body between said opposite side edges and perpendicularly to said side edges,
10 said first set of tendons comprising a plurality of pairs of tendons,
 each of said pairs of said first set comprising a first tendon and a second tendon,
 said first tendons of said first set extending one through each of said longitudinal ribs and said second tendons of said first set being positioned one beneath each of said first tendons;
15 said first tendons of said first set being positioned a first predetermined distance from said centroidal plane,
 said second tendons of said first set being positioned said first predetermined distance on the side of centroidal plane opposite said first tendons,
 said second set of tendons comprising a plurality of pairs of tendons,
20 each of said pairs of said second set comprising a third tendon and a fourth tendon,
 said third tendons extending one through each of said lateral ribs and said fourth tendons being positioned one beneath each of said third tendons,
 said third tendons being parallel to said plane and on the same side of said plane
25 on said first tendons and being spaced a second predetermined distance from said centroidal plane such that said third tendons are tangential to each of said first tendons,
 said fourth tendons being parallel to said centroidal plane and on the same side of said plane as said second tendons and being spaced said second predetermined

distance from said plane whereby said fourth tendons are tangential to each of said second tendons.

17. A thin, reinforced concrete panel comprising a substantially rectangular
5 body of concrete having a first flat face and an opposite, parallel, second flat face, a pair of opposite parallel side edges and a pair of opposite parallel end edges, and having a mid-plane between said faces.

a first set of a plurality of prestressed tendons extending laterally of said panel between said side edges and perpendicularly to said side edges,

10 a second set of a plurality of prestressed tendons extending longitudinally of said panel between said end edges and perpendicularly to said end edges,

said first set of tendons being positioned in equal number and equidistantly from and on opposite sides of said mid-plane,

said second set of tendons being positioned in equal number and equidistantly
15 from and on opposite sides of said mid-plane.

18. A concrete panel as set forth in claim 17 wherein the tendons of said first set on the opposite sides of said mid-plane lie in parallel planes perpendicularly to said mid-plane.

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19. A concrete panel as set forth in claim 17 wherein the tendons of said second set on the opposite sides of said mid-plane lie in parallel planes perpendicular to said mid-plane.

20. A concrete panel as set forth in claim 18 wherein the tendons of said first set on one side of said mid-plane lie in parallel planes spaced longitudinally from the parallel planes containing the tendons of said first on the opposite side of said mid-plane.

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21. A concrete panel as set forth in claim 18 wherein the tendons of said second set on one side of said mid-plane lie in parallel planes spaced laterally from the parallel planes containing the tendons of said second set on the opposite side of said mid-plane.

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22. A thin, reinforced concrete panel comprising a substantially rectangular body of concrete having a first face and an opposite second face, said faces being flat and parallel to one another with a panel mid plane between said faces; a pair of opposite side edges; and a pair of opposite end edges,

10 a first set of prestressed, parallel tendons extending through said body between said opposite end edges,

a second set of prestressed, parallel tendons extending through said body between said opposite side,

said first set of tendons comprising a plurality of pairs of tendons,

15 each of said pairs of said first set comprising a first tendon and a second tendon, said first tendons being positioned a first distance from said mid plane and between said mid plane and said first face of said body,

said second tendons being positioned a second distance from said mid plane and between said mid plane and said second face of said body,

20 said first and second tendons of each pair being offset laterally from one another,

said second set of tendons comprising a plurality of pairs of tendons,

each of said pairs of said second set comprising a third tendon and a fourth tendon,

25 said third tendon being positioned a third distance from said mid plane and between said mid plane and said first face of said body,

said fourth tendon being positioned a fourth distance from said mid plane and between said mid plane and said second face of said body,

said third and fourth tendons of each pair being offset laterally from one another,
and
each of said tendons being pretensioned to substantially the same tension.

5 23. The concrete panel of claim 22, wherein said first and second distances
are unequal.

 24. The concrete panel of claim 22, wherein said third and fourth distances
are unequal.

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 25. The concrete panel of claim 22, wherein said first and second tendons in
a pair of tendons are spaced apart and have a centerline therebetween and said
centerline is offset a selected offset distance from the mid-plane toward one of said
faces of the panel.

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 26. The concrete panel of claim 25, wherein said offset distance may be in a
range up to 10% of the total thickness of the panel between said first face and said
second face.

20 27. The concrete panel of claim 22, which further comprises connecting
means for attaching said panel to an adjacent support structure.

 28. The concrete panel of claim 27, wherein said connecting means
comprises a groove formed in an edge of said panel adapted to receive a connecting clip
25 attached to said support structure.

 29. The concrete panel of claim 27, wherein said connecting means
comprises a threaded anchor imbedded in said concrete body.

30. The concrete panel of claim 29, wherein said threaded anchor is internally threaded to receive a screw.

31. The concrete panel of claim 27, wherein said connecting means
5 comprises a support member connected to at least one tendon to position the support member during the process of casting the concrete panel, said support member having a bore extending therethrough, the central axis of which is substantially normal to a face of said panel, and a screw plug having external threads thereon screwed into said bore with an internally threaded bore opening to the face of the panel.

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32. The concrete panel of claim 31, wherein said screw plug has an outer end and said external threads permit adjustment of said screw plug in said bore to position said outer end substantially flush with said face of the panel.

15 33. Apparatus for casting thin reinforced concrete panels having a plurality of prestressed elongate tendons of a predetermined diameter extending therethrough, the apparatus comprising,

a mold having a bottom plate with a flat upper surface, a pair of spaced opposed side portions extending upwardly from said bottom plate and having upper edges, a pair
20 of spaced opposed end portions extending upwardly from said bottom plate and having upper edges, said upper edges occupying a plane parallel to the upper surface of said bottom plate,

a first set of aligned slots defined in the end portions of the mold for receiving tendons extending therebetween,

25 a second set of aligned slots defined in the side portions of the mold for receiving tendons extending therebetween,

the first set of slots comprising a plurality of pairs of slots, each of said pairs of first set of slots comprising a first slot and a second slot, with the first slots each having a bottom surface spaced a first predetermined distance from the plate upper surface

which is less than one half the distance between the bottom plate and said plane, the second slots each having a bottom surface spaced a second predetermined distance from the plate upper surface which is greater than one half the distance between the bottom plate and said plane, and the first and second slots in each pair are offset laterally from each other, and

the second set of slots comprising a plurality of pairs of slots, each of said pairs of said second set of slots comprising a third slot and a fourth slot, with the third slot having a bottom surface spaced a third predetermined distance from said plate upper surface which is less than one half the distance between the bottom plate and said plane, the fourth slot having a bottom surface spaced a fourth predetermined distance from said plate upper surface which is greater than one half the distance between the bottom plate and said plane, and the third and fourth slots of each pair are offset laterally from each other.

34. The apparatus of claim 33 further comprising first stressing mechanism mounted adjacent one of said side portions for prestressing a tendon extending between the side portions, and second stressing mechanism mounted adjacent one of said end portions for prestressing a tendon extending between the end portions.

35. The apparatus of claim 33 wherein said plate upper surface and said plane are spaced apart a distance no greater than about 1.5 inches.

36. The apparatus of claim 35 wherein the bottom surface of each of said slots is spaced from said plate upper surface a distance no less than $1 \frac{1}{2}$ times the diameter of said tendons.

37. The apparatus of claim 36 wherein the bottom surface of each of said slots is spaced from said plane a distance no less than $2 \frac{1}{2}$ times the diameter of a tendon.